THE DATE OF MAHABHARATA
BASED ON THE INDIAN ASTRONOMICAL WORKS

K.V. Ramakrishna Rao, B.Sc.,M.A.,A.M.I.E.,C.Eng.(I).,B.L., *

Introduction

The date of Mahabharat is analyzed for determination only based on the Indian astronomical works. The following facts are taken into consideration for such critical study:

1. The Indian astronomers of Siddhantic works and followers have recorded the date of *Bharata* implying *Mahabharata* war in particular and starting of *Kaliyuga* or Era, that is used to reckon the dates of themselves at many places and in conjunction with Saka era in some places later.

2. Aryabhata makes a specific mention about *Bharata* in his *Aryabhatiyam*. Most of the scholars including westerners have taken the connotation of it as referring to *Mahabharata* and in particular *Mahabharata* war, because, that is considered as the staring point of Kaliyuga / era in Indian astronomy and history too.

3. Therefore, taking the astronomical works - Siddhantas, Tantras and Karanas like - *Aryabhatiyam, Mahabhaskariyam, Vatesvara - Siddhanta* and *Gola, Sisyadhivrddhida Tantra* and the commentaries thereof, the significance of such references are studied to find out the date of *Mahabharata*, only based on these ancient Indian astronomical works.

4. As the authors and commentators have been´astronomers, their authenticity about the astronomical data and information are reliable and taken for interpretaion. Moreover, if the chronology of any ancient dynasty is taken for study one can find that its origin goes back to *Mahabharata*[1] and even beyond. It is not a myth or fantasy,[2] but an historical fact that has not been accepted by the historians on the plea that there are no archaeological evidences.

* 25 (old 9), Venkatachala Iyer Street, West Mambulam, Chennai-600033.

Aryabhata's Reference about "Bharata"

According to scholars, it is Aryabhata (b. 426 CE) who for the first time mentions about Bharata in his work while giving the number of years elapsed since the starting of the present *kalpa*. He uses the specific expression *bharat purvam,* thus the commentators since his times to present day have been stimulated with inquisition and thus have analyzed, studied and interpreted critically.

The verse goes (*Aryabhatiyam*.I.5) like this:

Kaho manvo da, manuyugaha: skha, gataste ca, manuyugaha: chuna ca|
Kalpadher yugapadha ga ca, gurudhivasacca, bharatat purvam||

The word *bharata* could denote one of the following : 1. The country, 2. *Mahabharata*, 3. Bharat battle, and 4. Bharatas i.e., Pandavas.

5.   Any person or King with the name Bharata [this is farfetched because, Aryabhata uses the word *Bhaarat* only and not *Bharat.* In Vedic literature, the word Bharat denotes to a particular group of people *Aitreya Brahmana.* 8.23; *Satapath Brahmana* 13.5.4.11, 21; *Tandya Maha Brahmana.* 15.5.23; A. B. 2.25, 3.18 and Bhaarat (Taitreya Samhita. 2.5.9) to fire / Agni and its / his association with Bharat i.e., the people). Derived from *bhr*=to nourish, support thus, *Bhaarat* or *Bharat* is nourisher or supporter].[3]

6.   The people of Bharat (from the Vedic estymological interpretation of Bhaarat as noted above).

Thus, the expression *bharata purvam* could be one of the following:

1.   Before Bharat, i.e., before the existence of the country Bharat (Whether the place or country or *dvīpam* or island is debatable because of the chronology involved).

2.   Before Bharat, i.e., before Mahabharat war.

3.   Before the *Mahabharata* events.

4.   Before the advent of the people of Bhaarat.

As astronomy is connected with the time and place, the possibility of the place of observation, whether it could be Bharat should be also

taken into consideration, as it is linked with the deluge / movement of India towards Asian continent / submergence of certain parts, disappearance of Saraswati river etc.

Some of the translations (the names of the translators are given within the brackets for convenience) are considered as follows:

"A day of Brahma (or kalpa) is equal to (a period of) 14 Manus and (the period of one) Manu is equal to 72 yugas. Since Thursday, the beginning of the current kalpa, 6 Manus, 27 yugas and 3 quarter yugas had elapsed before the beginning of the current Kaliyuga (literally before Bharata" (K. S. Shukla[4]).

"There are fourteen Manus in a kalpa, the day of Brahma and sixty-two Mahayugas is a Manu. Of the present kalpa six Manus, twenty-seven Mahayugas of the seventh Manu as also the three-fouths of a Mahayuga passed before Thursday on which the Great War of the Mahabharata ended" (P.C. Sengupta[5]).

The Discussion of the Commentators on *bharat purvam*

The commentators of *Aryabhatiyam* have explained the significance of the expression used. For critical study, the commentaries of Bhaskara I, Somesvara and Suryadeva Yajvan are considered, so that their view prevalent during their period could be understood.

Bhaskara I (c.550-629CE) has interpreted as meaning *bharat purvam* as follows[6]:

1. The day of the Guru is the *Gurudivasa* i.e., Thursday.
2. From that Thursday, the end of Bharat (war) and the starting of Kaliyuga are reckoned.
3. Whatever Aryabhata told earlier is different, the *yugas* had gone.
4. As *yugas* had gone, so also the parts of the *yugas*.

Somesvara (f. 1040 CE) in his commentary takes the expression *bharata purvam* as "before the commencement of (Maha)bharat (battle)". Therefore, Bhaskara and Someswara had known the sigificance of the association of Bharat War with the starting of the Kaliyuga. This is further confirmed by the elaborate explanation of Suryadeva Yajvan (c.12th cent.CE). Suryadeva Yajvan[7] (b. 1191 CE) has interpreted as

meaning *bharat purvam* "before Yuddhistira":

1. Out of the four parts, three parts of *yugas* have gone. After the expiry of 27 *yugas*, three quarter of a *yuga* has also gone. The 28th *yuga* has come.

2. Thus, the first day is Gurudivasa i.e., Thursday. From that day onwards, the Kaliyuga starts.

3. In Bharat, the Bharatas like Yuddhistira witnessed the Thursday.

4. The heroes of the (Maha)bharat who witnessed such Thursday relinquished their royal life and started their "Mahāprastānam", the "Great Renouncement of Mundane Life".

5. Thus, the Thursday is famous as "Bharatagurudivas", the Great Thurday of Bharats or Bharat War.

6. That Thursday is also the last day of Dvaparyuga.

7. Thus,the Kaliuga starts with a Friday.

Therefore the Indian astronomers and the commentators have consistently taken "yuga" as "Kaliyuga", "Bharat" as "Mahabharat" War or associating with Mahabharat.

Modern scholars like P.C. Sengupta[8] (1927) and W.E. Clark[9] (1930) have also taken the meaning of the expression *bharatat purvam* as "before the commencement of Mahabharat battle".

From the literary and epigraphical evidences, it can be noticed that the usage of such concepts *yuga, kalpa, pralaya* etc., and the names of the *yugas* are related to Brahman period (c. 1800-1400 BCE) and Mauryan period (300 BCE) has only been used in the astronomical works dated later period. For example, the *vyatipada* principle used by Aryabhata is found in Vadanga Jyotisha of Lagadha[10] (c. 1400 BCE). These evidences prove the continuity of the Vedic astronomy through Siddhantic and later astronomical works.

How it is Linked with the Dates of Indian astronomers?

The ancient Indian astronomers perhaps purposely linked the determination of their dates of birth, composition of their works, calculation of number of years elapsed etc., based on two eras Kali and Saka. Therefore, without the significance of these two eras, the dates cannot be determined specifically.

Shastabdhanam shastardha vyatitas trashyam yugapadha |
Trayadhika vimsati rabdhastdheha mama janmanoatita ||

> *"When sixty times sixty years and three quarter yugas (off the current yuga) had elapsed, twenty three years had then passed since my birth"* (K.S. Shukla).

> *"Now when sixty times sixty years and three quarter Yugas also have passed, twenty increased by three years have elapsed since my birth"* (P.C. Sengupta).

> "I was born at the end of Kali 3600; I write this work when I am 23 years old i.e., at the end of Kali 3623" (T.S. Kuppanna Sastry[11]).

Here, though only Yuga is mentioned, Kaliyuga is implied and its starting of 3102 BCE is taken for reckoning purpose. Thus, the date of Aryabhata is determined as follows:

The years of birth=3600-3102=488 / 499-23=476 CE. This has been accepted by most of the scholars and generally considered as accepted date. Had the commencement year 3102 BCE is a myth or not astronomical one, the year of Aryabhata cannot be historical date or could be determined like this using 3102 BCE.

Bhaskara I in his commentary to Aryabhatiya mentions as follows (Ch. I. verse. 9):

Kalpa dherabdh nirodh adhayam abdha rashiritiritaha:
khagnya dhri ramarkarasava surandhrena dhavaha: te cangkkairapi
1986123730

> *"Since the beginning of the current Kalpa, the number of years elapsed is this: zero, three, seven. three, twelve, six, eight, nine, one (proceeding from right to left) years. The same (years) in figures are 19.8.61.23.730".*

Kalpadherabdh anirodhat gatakalaha:
khagnya dhri ramarkarasava surandhrena dhavaha: te ca 1986123730

> *"The time elapsed, in terms of years, since the commencement of the current kalpa is zero, three, seven, three, twelve, six, eight,nine, one (years written in figures) are 1986123730".*

Aryabhata gives the number of years elapsed since the beginning of the current yuga

$$= 6 \text{ Manus} + 27^3/_4 \text{ yugas}$$
$$= 6 \times 72 \text{ yugas} + ^3/_4 \text{ yugas}$$
$$= 6 \times 72 + 27^3/_4) \times 43,20,000 \text{ years}$$
$$= (1866240000 + 119880000) \text{ years}$$
$$= 198612000 \text{ years}.$$

From this, we can calculate the number of years elapsed since Bhaskara wrote his commentary

$$= 19861230 - 198612000 = 3730 \text{ years}$$
$$= 3730 - 3102$$
$$= 628 / 629 \text{ CE}.$$

Bhaskaracharya and others too imply Kaliyua/era in their works as revealed through commentators, as their dates are determined with the calculations reckoning the date of starting of Kaliyuga / era as 3102 BCE.

Mahabharata and Kaliyuga

The starting of Kaliyuga has been associated with the following events.[12] 1. The end of Mahabharat war, 2. The death of Sri Krishna, 3. The deluge, which made Dwaraka, submerged, 4. Coronation of Yudhistira, and 5. The renouncement of Yuddhistira.

In Indian astronomical works including Tantras and Karanas, the word *yuga* has been taken as *Kaliyuga* for calculating, illustrative and explanatory purposes. In a Tantra, the epoch is the beginning of Kaliyuga or 3102 BCE. In a Karana, any convenient epoch is selected by the astronomer.

"The Saka year (when the civil days are required) added to 3179 gives the solar years elapsed since the beginning of the Kaliyuga" **(Sisyadhivrddhida-Tantra**[13]-hereinafter mentioned as ST - of Lalla.I.12).

Here, that the Saka year began 3179 after the beginning of the Kaliyuga is specifically mentioned. Moreover, in the calculation of days elapsed, solar years elapsed, Suddhi etc., Kaliyuga is repeatedly mentioned and used for illustrations.

"...the solar months elapsed since the beginning of the Kaliyuga multiplied by 22,26,389 and divided by 21,60,0000 give the corresponding lunar months" (ST.I.15).

The commentators Bhaskara I, Somesvara, Suryadeva, Suryadeva Yajvan and others have pointed out the relation between *Mahabharata* and Kaliyuga.

Mahabharata and Kali and Saka Eras

The usage of Kali era by the astronomers with the *Mahabharata*, that too, with Mahabharat war in particular, has been consistent. Many astronomers mention Kali era and Saka era together.

"Since the birth of Brahma up to the beginning of the Saka era, 8½ years (of Brahma), ½ month (of Brahma), 6 Manus of the (current) day (of Brahma), 27¾ yugas, and 3179 years of the (current) Kali era had gone by" (**Vatesvara Siddhanta.**[14] I.10, K.S. Shukla).

Here, the number of years 3179 specifically mentioned is to obtain any year in terms of Saka, but it has been derived from the Kali era i.e., 3102 / 3101+78=3180 / 3179. As Vatesvara (c. 880-960 CE) uses the notation, it is evident that even during the 9th century it had been very popular among the astronomers and established one. He also records his year of birth in that fashion as explained below.

After Aryabhata, astronomers use the computation of years in Saka and as well as Kali Eras. The number of years to be reckoned in Saka with respect to Kali is given as 3179 and this is obtained by adding 78 to 3101 / 3102, thus, 3101+78=3179.

Thus, the Tantra directs: *Navadhrirupagniyuttam mahibhujam shakendratnam gatavarshadaraham* (I.4) meaning, "Add 3179 to the Saka years elapsed, the Kali years elapsed are obtained". Thus, it is evident that such method of reckoning of years in Saka Era related to Kali Era and vice versa had been in vogue before 6th century.

Vateswara says: "When 802 years had elapsed since the commencement of the Saka era, my birth took place; and when 24 years had passed since my birth, this Siddhanta was written by me by the grace of the heavenly bodies" (I.21).

Thus, the year of birth=802+78=880 CE and that of his work=880+24=904 CE.

The astronomers use certain Sakas as illustrative examples in their works. For example Mallikarjuna Suri and Candesvara, an astronomer of Mitthila, use 1100 and 1107 Sakas for illustrating rules.

Mahabharata and 3102 BCE

The above discussion about Kaliyuga and Kali era amply proves its astronomical importance in time reckoning. It also points to the well established date of such reckoning starting with 3102 BCE and its connection with *Mahabharat*. The Saka Era has also been associated with it as starting 3179 after the starting of Kali Era. The date 3102 / 3101 BCE is very often used by the epigraphists, numismatists, archaeologists, historians, astronomers and others, but, assert that Kali Era / Yuga is a myth! Therefore, the application of 3102 BCE to determine and calculate other dates should be explained properly, because, the modern scholars use the same date, but even condemn and criticize it unwittingly at many places.

That the astronomical interpretation of 3102 BCE continues with international scholars e.g., B.L. Va der Waerden[15] (-1996), Sepp Rothwangl[16], B.N. Narahari Achar[17] even today proves its continuance of its importance in the World astronomical research and studies, as now, they attribute the observation of such conjunction or planetary alignment to non-Indian!

Roger Louis Billard[18] (1922-2000) has graphically tried to show that most of the Indian astronomical works were written around c.500 CE. In fact, his scale does not go beyond 500 BCE, because that is the limit fixed for the antiquity. But, the fact is that this date has been only the date of corrections made according to the *ayanāmsa* and other factors taking into consideration around 479 CE. Therefore, naturally, the works would appear to have written around such date. But, the original text attributed to Aryabhata and others go back to earlier period. The existence of astronomical works like Vedanga Jyotisa of Lagadha (c.1400 BCE), Suriyapannatti or Suya-prajnapti (c.300 BCE) etc., prove the fact. Similarly, B.L. Va der Waerden tried to show that the 3102 BCE calculations were worked backwards by Indians copying from the tables constructed based on Greek astronomy. He also attempted to show that the actual observation was made by a Greek around 3100 BCE and not by an Indian.

Some of the recent discussions are tabulated as follows for ready reference:

Sl. No.	Research dealt with	Title / work	Source available
1	B.L. Van Der Waerden	The Conjunction of 3102 BCE	Centaurus, 1980, Vol. 24 pp. 117-131.
2	B.L. Van Der Waerden	The Great Year in Greek, Persian and Hindu History of Astronomy	Archive for History of Exact Sciences, Vol. 18, 1978, pp.357-384.
3	Sepp Rothwangl	300-year-fake-Is there a Medieval 300-year-time fake?	2000.
4	Sepp Rothwangl	Considerations About the Start of the age of Aquaris,	2000.
5	Romila	Is This the New Millennium?	The Folio issued by The Hindu, Jan. 23.2000, pp. 6-7

Was it a Thursday or Friday or Sunday?

The controversy is age-old as the astronomers themselves. This is probably a confusion that has arisen in the minds of the intellectuals, because of the gap in their application of astronomical principles. However, as it has bearing on the determination of 3102 BCE and days connected, it is discussed here. Aryabhata applies the *Ardharatrika* system of reckoning that too specifically from Lanka. Many of his crucial verses point to actual observations made from Lanka, whereas, the later day astronomer-commentators interpret according to their positions or with reference to Ujjaini.

Brahmagupta criticizes Aryabhata for his teaching in the above verse discussed, in which the expression *bharatat purvam* is mentioned. For convenience, it is reproduced as follows:

Kaho manvo da, manuyugaha:sakha, gataste ca, manuyugaha:chuna ca| Kalpadheryugapadha ga ca, gurudhivasacca, bharata purvam||

The criticism of Aryabhata by Brahmagupta and the counter-criticism of Brahmagupta by Vatesvara point by point is tabulated as follows:

Brahmagupta's ciriticism (7th cent. CE)	Vatesvara's reply to the criticism (904 CE)
Since the measures of a Manu, a (quarter) yuga and a Kalpa and the periods of time elapsed since the beginnings of Kalpa and Kritayuga (as taught by Aryabhata) are not in conformity with those taught in the Smritis, it follows that Aryabhata is not aware of the mean motions (of the planets) (*BrSpSi*, xi. 10).	If the yuga stated by Brahmagupta conforms to the teachings of the Smritis, how is it that Moon(according to him)is not beyond the Sun (as stated in the Smritis). If that is unacceptable because that statement of the Smritis is false, then alas, the yuga-hypothesis of the Smritis, too is false (VaSi, *Grahaganita*, Ch. 1, Sec. 10 vs.3)
Since Aryabhata states that three quarter yugas had elapsed at the beginning of Kaliyuga, the beginning of the current yuga and the end of the past yuga (according to him) occurred in the midst of Kritayuga; so his yuga is not the true one (*BrSpSi*, xi.4).	Since a planet does not make complete revolutions during the quarter yuga acceptable to Brahmagupta, son of Jisnu, (whereas it does during the quarter yugas according to Aryabhata), it follows that the quarter yugas of Brahmagupta) are the correct ones (VaSi,*Grahaganbita*, Ch.1, Sec. 10, vs.2)
Since the intial day on which the Kalpa started according to (Aryabhata's) sunrise system of astronomy is Thursday and not Sunday (as it ought to be), the very basis has become discordant (*BrSpSi*, xi. 11).	If a Kalpa should begin with a Sunday, how is it that Brahmagupta's Kalpa does not end with a Saturday. Brahmagupta's Kalpa being thus contradictory to his own statement, it is a fabrication of his own mind (and is by no means authoritative) VaSi, *Grahaganita*, Ch.1, Sec.10, vs.10)

The criticism and counter-criticism made with the gaps of 250 years each only proves the following:

1. The original texts were continuously changed and the originality of Aryabhata's system of observation, recording etc., slowly forgotten or interpreted differently.

2. That there had been Smritis, which also had dealt with yugas, kalpas and time reckoning is proved.

3. Therefore, that Aryabhata only first introduced Kaliyuga concept, yuga reckoning etc., are not correct, as such principles were dealt with in Smritis also before Aryabhata.

4. The material period had been marked with critical study of astronomy and astronomical work without any political influence and disturbances.

The importance of origin of fixation of the Indian Prime Meridian at Ujjaini is to be taken into cognizance. The dating of Ujjiani with Prime Meridian goes back to 59 / 58 BCE associating with the starting of Vikrama Era. As already pointed out, Aryabhata's observations must have taken place at Lanka, which has to be located on *niraksha* 0^0 latitude i.e., equator, during his days. Though, he has been associated with Asmaka, his relation to the South has also been significant. His observations made from Lanka is in consistent with the following:

1. The observation made on 17th / 18th February 3102 BCE.
2. The Grand / Great Conjunction of planets.
3. Deluge occurred at some parts of the world, particularly at the Mediterranean area.
4. The destruction / catastrophe took place after a Great War.

The Popularity of the Astronomers in South and North:

Bhaskara I (c.500-628 CE) was not heard of in the north, whereas his work had been very popular in the South. Again, the astronomy was practiced in Kerala till 18th century from fouth century CE. Sundraraja (c.1500 CE) of Tamizhagam in his commentary on the *Vakya-karana* mentions Vatesa (Vatesvara) along with Aryabhata I, Lalla and other Indian astronomers. There has been claims that Aryabhata belongs to Kerala, Tamilnadu and so on. In any case, the importance of South India is noticed. Incidentally, it has to be noted that the Kali Era reckoning starting with 3102 BCE had been famous in South India and the astronomical tables and charts of 3102 BCE taken to Europe and studied by the European scientists, astronomers and other scholars were also from South India.

Was the date 3102 BCE attributed to Mahabharat War was an observed one or Worked Backwards?

Of late, as more and more scholars, particularly, the astronomers started accepting the date 3102 BCE, some counterclaims are made to stress that the said date is not associated with any actual observation,but on calculations worked backwards. Then, the arguments is extended as, even if such calculations were worked backwards by the Indians, the actual observation might have been made by a Greek. This is similar to the old controversy nourished by the British/European scholars earlier

since 17th century and developed by John Bentley.

John Playfair (1748-1819), a Scottish geologist and mathematician at Edinburgh University read a paper "Remarks on the Astronomy of Brahmins" on March 2, 1789, in which he proves that the caculation starting with 3102 BCE is mathematically, correct. In 1797, he published another paper "Observations on the Trigonometrical Tables of the Brahmins". Based on the confirmations of Bailly, Cassini and De La Place, he enumerated the following astronomical elements, to which the Indian tables agree each other:

Sl. No.	Astronomical factor under consideration	Indian value	Modern/western value	Difference
1	The inequality of the precession of the equinoxes.	54°	54°	NIL
2	The acceleration of the moon	5° 43' 7''	5° 44' 14''	1' 7''
3	The length of the syderial year	365^d 6^h 12' 30''	365^d 5^h 50' 35''	1' 46''
4	The length of the solar year	365^d 5^h 50' 45''	365^d 5^h 50' 45''	NIL
5	The mean place of the sun	10^s 3° 38' 13''	10' 2° 51' 19''	47''
6	The mean place of the moon	10^s 6° 37' 0'' KE 10^s 6° 0' 0'' TT	10^s 0° 51' 16''	5° 45' 44''
7	The equation of the sun's centre.	2° 8' 14''	2° 8' 16''	2'
8	The obliquity of the eclecptic	23° 51' 13''	23° 57' 45''	
9	The place of Jupiter's aphelion	3^s 27° 0'	3^s 16° 48' 58'' 3' 26° 50' 40''	10° 10' 40''
10	The equation of Saturn's centre	7° 39' 44''	7° 41' 22''	less 1' 38''
11	The inequalities in the mean motion of Jupiter.	30° 20' 42''	30° 20' 42''	NIL
12	The inequalities in the mean motion of Saturn	12° 13' 13''	12° 13' 14''	less 1''

Even in modern day scientific methods, statistical methods are applied to arrive at some conclusion. For example, Fred Espenak,[19] in his *Six Millennium Catalogue of Solar Eclipses* (from 1999 BCE to 4000 CE), has shown that during every century interval, the number of eclipses occurred / occur varied / vary from 225 to 225, Partial eclipses from

73 to 96, Annular eclipses from 62 to 92, Total eclipses from 54 to 71 and Hybrid eclipses from 0 to 25. Such results obtained have been based on certain statistical factors which in turn based on calculated from empirical fits, published observations and extrapolated values. However, he has not gone beyond 2000 BCE. Therefore, if data are obtained up to 4000 BCE, the facts about 3102 BCE can be verified. Similarly, the Conjunction could be an alignment, which could be also simulated to cross check.

Had it been an observed one, that person must have known the Mahabharat war also. Incidentally, scholars forget or ignore to note the evidence given by Aryabhata (*Kalakriya*. 11):

Yuga varsha masa divasa: samam pravruttastu caitra shukladhe
Kalo ayamno dhyanto gruhabairan umiyate cetre

This is the next verse, in which he gives his year of birth reckoned from the Kali. The meaning of this verse is:

> "The yuga, the year, the month, and the day commenced simultaneously at the beginning of the light half of Caitra. This time, which is without beginning and end, is measured with the help of the planets and the asterisms on the Celestial Sphere"

This is repeated in *Brahma-sphutha-Siddhanta* (i.4), *Maha-Siddhanta* of Aryabhata II (i.5), *Siddhanta-sekhara* (i.10), *Siddhanta-siromani* of Bhaskara II (I.i. 15). Chaitra is "Tula-Vrischika". The beginning of Yuga is defined as the time when all planets are simultaneously on the horizon at Lanka at the first point of Aries. Incidentally, *Surya Siddhanta* after explaining the passage of yugas etc., clearly records that the current year began with the light half of Caitra (Chap. IV, verse. 48). Again, the starting of 3102 BCE with Caitra Shukla has been the reckoning adopted by the South Indian school of astronomy. This is the day i.e., on the first day of Chaitra of the Pramathi, Lord Krishna left this world and the present Kaliyuga started. Therefore, the observation of 3102 BCE conjunction points to South India, probably, in Lanka (not the present Sri Lanka), as has been asserted by Aryabhata himself. When the people of northern India and Dwaraka faced with Mahabharat War and deluge respectively, the people at Lanka at far South, must have existed and the astronomers among them noticed the Conjunction and recorded. Thus, the Kali era became famous in south India.

Conclusion

The date of *Mahabharat*, and Mahabharat war in particular, has been an important event in Indian history, though, the modern scholars do not accept the historicity of it. However, without its mentioning, the history of Indian astronomy is not complete. As the Indian astronomical works had been corrected incorporating the periodical observations, certain changes have crept into the works. Therefore, the dates of such a corrections cannot be taken as the dates of the original works. John Bentley earlier and Roger Billard now have attempted to project such view. This would only date the works in recent times. The unnecessary crowding of astronomers around c.500 CE appears to be artificial and not astronomical.[20] The dating of Kaliyuga / Era as 3102 BCE has been the sheet anchor of Indian astronomy, whether, one wants it or otherwise. Even, the scholars, who fix different dates for Mahabharat, have to depend on 3102 BCE for determining their differed dates. The Indian astronomers starting with Aryabhata to others have known the date of Mahabharat war and its connection with Kali Yuga / Era and thus, their works and commentaries have been consistent. That the date 3102 BCE has been discussed by many astronomers, scientists and scholars of many fields even today proves its importance in the Indian as well as world history.

Notes and References :

The astronomical works referred to with the dates of Indian astronomers are given as follows:

Author	Work	Date
Revealed to Mayasura by Sun.	Surya Siddhanta	c.300 BCE, 300 CE, 400 CE etc
Aryabhata	Aryabhatiyam	b. 476 CE
Varahamihira	Pancasiddhantika	b. 525 CE
Prabhakara	Commentary on Aryabhatiyam	c. 525 CE
Varahamihira	Pacasiddhantika	c. 550 CE
Brahmagupta	Khandakhadyaka Commentary on Aryabhatiyam	b. 598/f.628 CE/7th cent.CE
-do-	Brahma-sputha-siddhanta	c. 628 CE
Bhaskara I	Commentary of Aryabhatiyam	f.629 CE (c.522 or c.550-627CE)
Lalla	Sisyadhivrddhida Tantra	c. 748 CE
Prthudakasvamin	Crommentary on Brahma-sputha-siddhanta	860 CE

Sankaranarayana	Commentary on Laghubhaskariyam	869 CE
Vatesvara	Siddhanta and Gola in 904CE	880 - c. 960 CE
Mallikarjuna Suri	Commentary on Tantra of Lalla	c. 1100 or 12th cent. CE
Suryadeva Yajva	Commentary on Aryabhatiyam	c. 12th cent. CE
Govindasvami	Mahabhaskariya	
Parameswara	Commentary on Mahabhaskariya	1431 CE / c. 14th cent. CE
Yallaya	Commentary on Aryabhatiyam	c.15th cent. CE
Nilakantha	Commentary on Aryabhatiyam	c. 15th - 16th cent. CE

The other sources are as follows :

1. Andrew Stirling, *An Account, Geographical, Statistical and Historical of Orissa Proper or Cuttack*, in *Asiatic Researches*, Vol. 15, 1822.

   ...., *Journal of Royal Asiatic Society of Bengal*, Vol. VI, Part-II, 1837. Here, the chronology is traced back to Yuddhistira who ruled 3095-3083 BCE. F.E. Pargiter, *The Indian Historical Tradition*, Motilal, New Delhi, 1999.

2. M. Winternitz, *A History of Indian Literature*, University of Calcutta, 1978, Vol. I, Part-II, p. 416.

3. Fatah Singh, *The Vedic Etymology*, The Sanskriti - Sadan, Kota, 1952, p. 117.

4. Kripa Shankar Shukla, *Aryabhatiya*, Indian National Science Academy, New Delhi, 1976, Part I. (Critical Edition with Translation).

5. Prabothchandra Sengupta (Trans.), "The Aryabhatiyam" *The Journal of the Department of Letters in the Calcutta University*, Calcutta, Vol. XVI, 1927, pp. 1-56.

6. K.S. Shukla, *Aryabhatiya of Aryabhata with the Commentary of Bhaskara I and Somesvara*. Indian National Science Academy, New Delhi, 1976. Part II (Critical Edition with commentary).

7. K.V. Sarma (Ed.), *Aryabhatiya with the Commentary of Suryadeva Yajvan*, Indian National Science Academy, New Delhi, 1976, (With introduction and Appendices).

8. P.C. Sengupta, *op.cit.*, p. 6-7.

9. Walter Eugene Clark (Trans.), *Aryabhatiya of Aryabhata*, University of Chicago, Press, Chicago, Illinois, 1930.

10. T.S. Kuppanna Sastry (Trans), *Vedanga Jyotisa of Lagadha*, Indian National Science Academy, New Delhi, 1985.

11. T.S. Kuppanna Sastry (Ed), *Mahabhaskariya of Bhaskaracarya with the Bhasya of Govindasvamin and the Super-commentary Siddhantadipika of Paramesvara*, Goverment Oriental Manuscripts Library, Madras, 1957.

12. *Mahabharat, Bhagavata* Purana, and other Puranas and astronomical works.

    Venkatesh Bapuji Ketkar, *Indian and Foreign Chronology with Theory, Practice and Tables*, Bombay Branch of the Royal Asiatic Society, Bombay, 1923.

13. Bina Chatterjee (Tr.), *Sisyadhivrddhida Tantra of Lalla*, Indian National Science Academy, New Delhi, 1981. Part I (Critical Edition and commentary) and Part II (Translation and Mathematical Notes).

14. K.S. Shukla, *Vatesvara-Siddhanta and Gola*, Indian National Science Academy, New Delhi, 1985. Part I (Critical Edition with text) and Part II (Translation and Commentary.

15. B.L. Van der Waerden, *The Conjunction of 3102 BCE*, Centaurus, 1980, Vol. 24, pp. 117-131.

    ...., *The Great Year of the Greek, Persian and Hindu History of Astronomy*, Archive for History of Exact Sciences, Vol. 18, 1978, pp. 357-384.

16. Sepp Rothwangl, *300-year-fake-Is there a Medieval 300-year-time fake?*, 2000.
    ...., *In Search of Acquarius*, available in website.

17. B.N. Narahari Achar, *A Critical Examination of the Astronomical References in Mahabharata and Their Simulation by Planetarium Software*, a paper presented. Also a talk given by him on October 2, 1991 at the University of Memphis. http://www.umassd.edu/indic/waves/obstracts.htm.

18. Roger Billard, Journal of Indian National Science Academy, New Delhi.

    S.N. Sen & K.S. Shukla, *History of Astronomy in India*, INSA, Delhi, 2nd Ed., 2000.

19. Fred Espenak, *Six Millennium Catalog of Solar Eclipses*, (from 1999 BCE to 4000 CE), http://sunearth.gsfc.nasa.gov/eclipse/Secat/Secatalog.html.

    Similar figures are available for planetary conjunction or alignment, which clearly prove that such event had occurred. http://nssdc.gsfc.nasa.gov/planetary/aligment.htm.

20. K.V. Ramaktishna Rao, *The Significance of the Year 499 CE in the Indian Astronomy*, Aryabhateeya '99, Tiruvanathapuram, 1999, p. 9.